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MINERAL RESOURCES
OF THE COUNTRY AS RELATED
TO FARM LANDS

LETTER
FROM THE
SECRETARY OF AGRICULTURE
TRANSMITTING

IN RESPONSE TO SENATE RESOLUTION No. 377 (71st
CONG.) A REPORT PERTAINING TO THE MINERAL
RESOURCES OF THE COUNTRY AS RELATED
TO FARM LANDS

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LETTER OF TRANSMITTAL

DEPARTMENT OF AGRICULTURE,
Washington, May 9, 1932.

The PRESIDENT OF THE SENATE.

SIR: Pursuant to the request made in Senate Resolution 377 of the Seventy-first Congress, I am submitting herewith a report pertaining to the mineral resources of the country as related to farm lands, prepared in the Bureau of Agricultural Economics of this department.

Sincerely yours,

ARTHUR M. HYDE, *Secretary.*

LETTER OF SUBMITTAL

DEPARTMENT OF AGRICULTURE,
BUREAU OF AGRICULTURAL ECONOMICS,
Washington, D. C., May 7, 1932.

The SECRETARY OF AGRICULTURE

DEAR MR. SECRETARY: There is submitted herewith a report pertaining to the petroleum resources of the country as related to farm lands. This report was prepared in response to Senate Resolution 377 of the Seventy-first Congress.

As pointed out to the Senate Committee on Agriculture and Forestry, in the department's letter of February 25, 1931, a survey of the extent and value of the mineral resources underlying farm lands is largely outside the usual activities of this department. It was then pointed out, also, that a comprehensive and complete study of co-operative pooling as a means of conserving for farmers the mineral rights in their lands could not be made with present facilities. As no additional facilities were provided for making this study, the report submitted is based upon such data as could be assembled without undue sacrifice of the bureau's regular work.

Because the geological phases of the subject lie outside the province of this bureau dependence has been placed wholly on authorities in that field for the information presented. Considerable economic information bearing on the cooperative pooling of mineral rights has been gathered, but there are specific economic and legal problems upon which further investigation is needed before more definite conclusions can be reached with reference to legislation.

The study, though in no sense exhaustive, indicates that mineral rights underlying farm lands represent great potential wealth in which farmers too often share inadequately. With agricultural incomes at low ebb there is an unusual temptation at this time to sell mineral rights for whatever may be offered. The cooperative pooling of farmers' mineral rights under proper safeguards provides an effective method of securing for them a fair share in this potential wealth.

The report was prepared by Dr. W. A. Hartman, assisted by other members of the bureau's staff, under the direction of Dr. L. C. Gray in charge of the Division of Land Economics.

Sincerely yours,

NILS A. OLSEN,
Chief, Bureau of Agricultural Economics.

MINERAL RESOURCES OF THE COUNTRY AS RELATED TO FARM LANDS¹

AUTHORITY FOR STUDY

This study was made in response to Senate Resolution 377, Seventy-first Congress, third session. The resolution was submitted to the Committee on Agriculture and Forestry, December 17, 1930. It was reported, considered, and passed February 17 (calendar day, February 26,) 1931, reading as follows:

Resolved, That the Secretary of Agriculture be, and he is hereby, requested to investigate, through the agency of the Bureau of Agricultural Economics, the mineral resources of the country as related to farm lands both as to the extent and as to the value of such resources as a farm asset, and to report such findings to the Senate and to recommend any legislation which may be deemed practicable and desirable to encourage cooperation among farmers with a view to the more efficient use of such resources as assets.

SCOPE OF STUDY

This report covers the results of a preliminary survey of relationships between the farmers who own potential petroleum lands, and the oil industry. The purpose has been to ascertain how the farmers may best utilize their equities in unmined oil and gas.) These potential resources are of great importance to landowners in the potential petroleum belts of the country. The geological data necessary for immediate consideration of the farmer's interest in potential petroleum resources were already available. The availability of geological data for considering the farmer's interest in other potential mineral resources has not been investigated.

(Suggestions here presented concerning methods and practices in the organization and management of cooperative pools for handling farmers' petroleum rights should be regarded as tentative rather than as fixed and final conclusions. No attempt is here made to consider the technical geological and legal questions in connection with a pooling program.) But it is possible that this report may be helpful in arriving at some practical plans for helping farmers to manage their oil and gas rights to greater advantage to themselves.

The data on which this report is based were obtained by the representative of the Department of Agriculture assigned to this project, through the following means:

(1) Interviews with State geologists, consulting geologists, and geologists employed by mineral acreage pooling corporations in the midcontinent oil and gas areas of the United States; geologists and economists at the Oklahoma Agricultural and Mechanical College, the University of Oklahoma, the University of Kansas, the New Mexico State School of Mines and Mineral Resources, and the University of Texas.

(2) Interviews with officials of corporations engaged in the business of pooling potential oil and gas acreage, with farmers who own what

¹ This report is based on studies and field surveys by Dr. W. A. Hartman, who also prepared the report under the direction of Dr. L. C. Gray, in charge of the Division of Land Economics, Bureau of Agricultural Economics.

is considered potential mineral acreage, and with officials or other corporations engaged in one or more phases of the oil and gas business.

(3) Interviews with officials of the Osage Indian Agency at Pawhuska, Okla.

(4) Study of reports of the Osage Indian Agency concerning the pooling of mineral rights of the Osage Tribe of Indians in Oklahoma; of the Federal Oil Reservation Board; of the United States Geological Survey; of the American Petroleum Institute; and of miscellaneous publications concerning different phases of the oil and gas industry.

(5) Interviews with many individuals familiar with different aspects of the petroleum business.²

LOCATING POTENTIAL PETROLEUM ACREAGE

It is generally agreed among geologists and oil and gas mining engineers that there is no certain way to locate oil and gas in advance of drilling. The percentage of dry holes drilled annually increased from 16 per cent in 1860 to 30 per cent in 1929. Of the 777,882 wells drilled in the United States between 1859 and 1928, more than one-fifth (21 per cent) proved to be dry holes (Table I).

This does not mean that attempts to find oil in new areas are 79 per cent successful, although that is implied in the "literature" of many shrewd salesmen of oil stock in "wildcat" wells in process of drilling. To illustrate, let us suppose certain conditions: A test well has been started on each of five properties. Four of the test wells turn out to be dry holes, but the fifth turns out to be a "gusher." On the tract containing the gusher, 16 other successful wells are subsequently drilled. The per cent of producing oil and gas wells in relation to dry holes is 80, but the per cent of discoveries made to tracts drilled is only 20. Statistics are not available to show the actual ratio between producing tracts and total tracts drilled.

TABLE 1.—*Summary of the total (wildcat plus proved area) wells drilled in the United States, 1859–1928, by major fields, arranged according to the largest number drilled* ^a

Field	Wells drilled, 1859–1928				
	Oil	Gas	Dry	Total	Dry
	Number	Number	Number	Number	Per cent
Appalachian	242,479	21,867	67,336	331,682	20.3
Mid-continent	176,043	20,800	60,563	257,406	23.5
Lima-Indiana	79,729	644	11,061	91,434	12.1
Illinois-Southwest Indiana	26,155	916	6,809	33,880	20.1
California	21,384	102	4,230	25,716	16.4
Gulf coast	15,872	380	9,075	25,327	35.8
Rocky Mountain	6,887	562	3,289	10,738	30.6
Michigan	448	33	212	693	30.6
Other	0	153	853	1,006	84.8
United States	568,997	45,457	163,428	777,882	21.0

^a Petroleum in the United States and Possessions, by Ralph Arnold and William J. Kemnitzer, p. 27. 1931.

² Special reference is made to the following individuals who cooperated with the investigator: Aldrich Blake, president American Mineral Corporation, Oklahoma City, Okla.; J. R. Klumpp, consulting geologist, Texas Osage Royalty Pool, San Antonio, Tex.; Kenneth K. Landes, assistant State geologist, Lawrence, Kans.; Leonard Logan, professor of economics, University of Oklahoma, Norman, Okla.; U. E. Monnett, director School of Geology, University of Oklahoma, Norman, Okla.; Daniel D. Murphy, superintendent Osage Indian Agency, Pawhuska, Okla.; Campbell Osborn, president and general manager Landowners Oil Association, Tulsa, Okla.; Irving Perrine, petroleum geologist, Oklahoma City, Okla.; E. H. Sellards, associate director Bureau of Economic Geology, University of Texas, Austin, Tex.; Earl A. Trager, consulting geologist, Tulsa, Okla.; E. H. Wells, president and director State School of Mines, Socorro, N. Mex.

Even to-day, with all the known methods of ascertaining whether oil or gas is likely to be found in a given area, geologists and oil and gas mining engineers can not be positive that a producing well has been located until the bit actually strikes producing sand.

The methods of determining surface structures have evolved from simple dip and strike measurements with clinometer and compass or alidade and plane table, to aerial photography. Buried structures were undeterminable and neglected until the advent of geophysical methods in the Gulf coast field about 1922. Up to then, most structures visible at the surface had been determined. Since 1922, the seismograph, torsion balance, and magnetometer, together with numerous other devices have been applied with success to one degree or another in nearly every field in the country. The most these instruments can do, however, is to determine structure, and not the actual presence of oil. Thus, geophysical methods have the same limitations on buried structures that ordinary methods have on surface structures.³

The mining aspects of the petroleum business are still highly speculative.

Several very large fields have developed from discoveries that were accidental, or, at any rate, are not directly the result of geologic recommendation, so that only something more than 50 per cent of the volume of our oil reserves can be credited to geologists. Even so, the record is entirely gratifying to geologists.

Nevertheless, there is much of the fortuitous in oil finding. When tremendous fields like greater Seminole and the new east Texas field can develop without being more clearly or generally anticipated by geologists than these fields were, it behooves the geologists to speak with some degree of humility. Much of our control is obscure, and even keen observers fail to detect or to interpret correctly the surface evidence. The Mexia field was discovered by a geologist, but the discovery well was located on what was conceived to be an anticline, when in reality, of course, the controlling structure is a fault. That the first well discovered oil was largely good fortune. The Hobbs field was drilled at the apparent center of a geophysical prospect, and the first well made oil, but the crest of the reservoir later proved to be more than a mile distant and much of the prolific field that developed lay outside the block of leases taken on the geophysical evidence. Reflect, also, on the hundreds of domes, anticlines, faults, and geophysical prospects that we drill without success. Most of them look like certain oil fields to some geologists before the well gets down.⁴

ESTIMATES OF PETROLEUM RESERVES

It is impossible for geologists and oil and gas mining engineers to estimate with any degree of accuracy the well oil and gas that can be produced in this country. From the first commercial production in 1859 to the year 1929, a total of 12,248,090,000 barrels was produced in the United States. The area in the United States that is considered by geologists to be potential oil-producing land totals over a billion acres. Deeper drilling in old pools continually discloses unsuspected reserves.

The experience of the United States Geological Survey illustrates the difficulty in estimating petroleum reserves. The first estimate of such reserves was made in 1908, by David T. Day, Chief Geologist of the United States Geological Survey. He estimated a minimum of 8,500,000,000 barrels and a maximum of 22,500,000,000 barrels—a range in which his maximum figure was more than two and one-half times his minimum estimate. The total production in the United States from the date of his estimate to 1929, inclusive, was

³ Arnold, Ralph, and Kemnitzer, William J., *Petroleum in the United States and Possessions*, Harper & Bros. 1931.

⁴ Pratt, Wallace E., *Industry Must Drill 20,000 Wells Yearly*. In *Oil and Gas Journal*, July 16, 1931. p. 19.

10,441,447,000 barrels, or 23 per cent more than his minimum estimate of reserves.⁵

In 1915, the United States Geological Survey estimated the total future production at 7,600,000,000 barrels. Between 1915 and 1929, inclusive, 8,912,633,000 barrels, or over one-sixth (17 per cent) more than the estimated total, were produced in the United States.⁶

In 1921, the United States Geological Survey in cooperation with the American Association of Petroleum Geologists, after considering producing, probable, and possible oil territory, estimated that the unmined reserves in the United States, recoverable by known methods of drilling and production, amounted to about 9,000,000,000 barrels of oil. As a matter of fact, between 1920 and 1931 nearly 9,000,000,000 barrels of oil were produced in the United States.⁶

Probably the most comprehensive available study and consequent estimate of the acreage having potential unmined petroleum resources in the United States were completed in 1925 by the technical advisors to the committee of 11⁷ appointed by the board of directors of the American Petroleum Institute. With respect to new oil fields this committee estimated the total area in the United States in which the discovery of new oil fields is possible at 1,105,454,459 acres and the total area unfavorable for oil at 827,790,752 acres. The two classes of areas are distributed as follows:

Districts	Area in which new oil fields may be found	Area unfavorable for oil
Eastern States		
Kentucky, Tennessee, and Southeastern States	179,893,860	174,097,100
Mid-continent and North Central States	148,925,036	63,078,112
Texas, Louisiana, Arkansas, and Mississippi	248,088,130	86,722,560
Rocky Mountain and Pacific Coast States	241,502,837	30,081,980
Total	287,044,596	473,811,000
	1,105,454,459	827,790,752

Speaking of potential oil and gas fields, the committee declared:

The area designated as unfavorable for the discovery of new fields includes exposures of igneous or metamorphic rocks and areas where, in the light of our accumulated experience, structural or stratigraphic conditions are known to be unfavorable for oil production. Some small favorable areas have been included with surrounding larger unfavorable areas, and some areas of very old sediments, even though not metamorphosed, have also been classified as unfavorable.

About 57 per cent of the total area of the United States is such that new oil fields may be discovered in it, whereas 43 per cent as described above is unfavorable for the occurrence of petroleum.

The rocks underlying the entire area in which the discovery of new oil fields is possible are of the same general character as those which yield the production from our proven fields. Over a considerable portion of it, other conditions which characterize the areas now producing in our present fields are known to exist. Throughout this part of it, and distributed over much of the possible area, are the oil fields which we have already discovered.

⁵ Independent Petroleum Association of America, mimeographed memorandum entitled, "Tariff on Oil," p. 4. (Not dated.)

⁶ Osborn, Campbell, Oil Economics, McGraw-Hill Book Co. (Ine.), 1932, p. 89.

⁷ J. Edgar Pew, president American Petroleum Institute, New York; vice president Sun Oil Co., Dallas, Tex.; E. W. Marland, president Marland Oil Co., Ponca City, Okla.; D. M. Folsom, director, General Petroleum Corporation, San Francisco; E. T. Wilson, chairman of the board, Continental Oil Co., Denver; K. R. Kingsbury, president Standard Oil Co. (California), San Francisco; George S. Davison, president Gulf Refining Co., Pittsburgh; W. S. Farish, president Humble Oil & Refining Co., Houston; J. C. Donnell, president Ohio Oil Co., Findlay, Ohio; W. N. Davis, president Mid-Continent Oil & Gas Association; vice president, Phillips Petroleum Co., Bartlesville, Okla.; Frank Haskell, president Tidal Oil Co., New York; and R. L. Weleb, general secretary, American Petroleum Institute, New York. (See American Petroleum Supply and Demand, first edition, p. 5, 1925, issued by the American Petroleum Institute.)

It would be a mistake, of course, to assume that all of the area designated as favorable for the discovery of new fields is to produce oil, and such an assumption is in no wise to be inferred from this discussion. The known requisites for oil fields are such that even in the most favorable territory only a very small proportion of the entire area yields production. Adequate source beds must be brought into close juxtaposition with appropriate reservoir rocks, and the combination of source and reservoir must acquire a special structural relationship before accumulation of petroleum can be effected. Only a very small per cent of the total area will become producing territory, or contribute to our supply of crude oil. But at intervals, widely spaced, perhaps, over the entire possible area, new oil fields may be found.

NEW PRODUCTION FROM NEW SANDS LIKELY

There is good evidence that in every one of the producing areas in the United States oil will be obtained in sands other than those now producing. Even in the Eastern fields, including the Appalachian district, where exploration has been active for more than a half century, it is reasonable to hope that new production will develop from some of the tests that are being drilled to deeper sands. In the Mid-Continent area, in Texas and the Gulf coast, in the Rocky Mountain region, and in California production is to be expected in many fields from sands other than those now yielding our oil.

Improved drilling methods will be perfected which will permit of exploration to depths much greater than those now attainable, and that over large parts of the area in which the discovery of new oil fields is possible, as well as in many of our proven fields, deeper drilling may open new reserves and very greatly increase our supplies of petroleum.

Improvements in geologic technique and more intensive application of scientific methods in the location of undiscovered oil deposits will become of increasing importance in the future as improvements in present methods and discovery of new methods and principles are made. Judging by the progress that has taken place in the past five years and the success that has already attended the use of scientific instruments in attempts to locate structures favorable for oil accumulation, there is reason to believe that the new methods will enable us to determine in advance of drilling the position of many favorable areas, which otherwise would be discovered only by haphazard drilling. The application of these methods will assist materially in the exploration of the large area in which the discovery of new oil fields is possible and will tend to offset the increasing difficulty of maintaining our oil supply. They should be considered as one method of defense against vanishing production.

Much oil has been found in the past in areas where there is no evidence of favorable structure at the surface. A large additional number of such occurrences must await the same chance discovery of haphazard drilling, in spite of all anticipated improvements in the technique of finding oil. It will require many years to complete the list of discoveries of this class, however intensely the search may be prosecuted over the area possible for the discovery of new oil fields.

The discovery of new oil fields is, by its very nature, a pioneering enterprise. The history of the oil industry is replete with instances in which new areas have been brought into production where conditions favorable for petroleum accumulation, as understood at the time, were believed to be nonexistent. Important discoveries of such fields have been made in the last few years in areas which on the basis of the information available at the time were placed in the same class as the area here designated as possible for the discovery of new oil fields. There is every reason to believe that future exploration will repeat the accomplishment of the past, with the result that many new producing districts will be discovered in the extensive area possible for the discovery of new oil fields.⁸

With respect to this large potential producing area the Federal Oil Conservation Board said:

Certain parts of the country are known by their geology to be impossible of appreciable oil production. Such positively barren areas are estimated to aggregate 43 per cent of the total area of the United States. But this does not warrant the assumption that the remaining 1,100,000,000 acres of the country, or any

⁸ American Petroleum Supply and Demand, a report to the board of directors of the American Petroleum Institute by a committee of 11 members of the board, McGraw-Hill Book Co. (Inc.), p. 50-53.

large part of them, will be found oil-bearing. Considerable portions of this area have already been drilled for oil or water. It is a certainty that we are learning each year more of geologic structure at the hands of a large body of public and private geologists but the percentage of dry holes in new exploration is increasing. To assert that no new fields will be found would be to deny a very strong law of probabilities. And we may conclude that such fields will be found, but obviously no forecast of their importance can be given.⁹

The fact that there is a large potential oil and gas producing acreage in the United States is emphasized further by the fact that Arnold and Kemnitzer estimated, in 1931, that 34.5 per cent (1,043,247 square miles) of the United States was prospective oil and gas producing land. The following quotation is taken from their text:¹⁰

The United States may be classified for petroleum on the basis of the kinds of rock covering its surface. In areas of igneous and metamorphic rocks, for example, petroleum does not occur; in areas where sedimentary rocks are in unsuitable structure and of adverse lithology, the chances for petroleum are poor; while in areas where sedimentary rocks are in suitable structure and favorable lithology petroleum may be found in certain limited localities.

The total area of the United States is 3,026,789 square miles of which 53,013 square miles, or 1.8 per cent is water. Of the total area, 610,649 square miles, or 20.2 per cent, is igneous or highly metamorphic rock in which oil and gas do not occur, and 1,359,599 square miles, or 44.9 per cent is sedimentary rock, the lithology and structure of which are unfavorable for oil and gas. The remaining area of 1,056,441 square miles, or 34.9 per cent of the total, comprise the proved and prospective oil and gas land, of which, up to January 1, 1929, approximately 13,193 square miles, or 1.25 per cent, had proved productive; 7,037 square miles, or 0.67 per cent, productive of oil, and 6,156 square miles, or 0.58 per cent, productive of gas only. (Table 2.)

The distribution of the proven or semiproven, the probable, and the possible oil and/or gas-producing lands in the United States is shown in Figure 1.¹¹ Sedimentary beds considered to be unfavorable for the formation of oil and gas reservoirs, and metamorphic and igneous beds considered as impossible oil and gas lands, are also shown in this map.

TABLE 2.—*Summary of a classification of land in the United States for oil and gas, January 1, 1929, by major fields, arranged in order of largest total area^a*

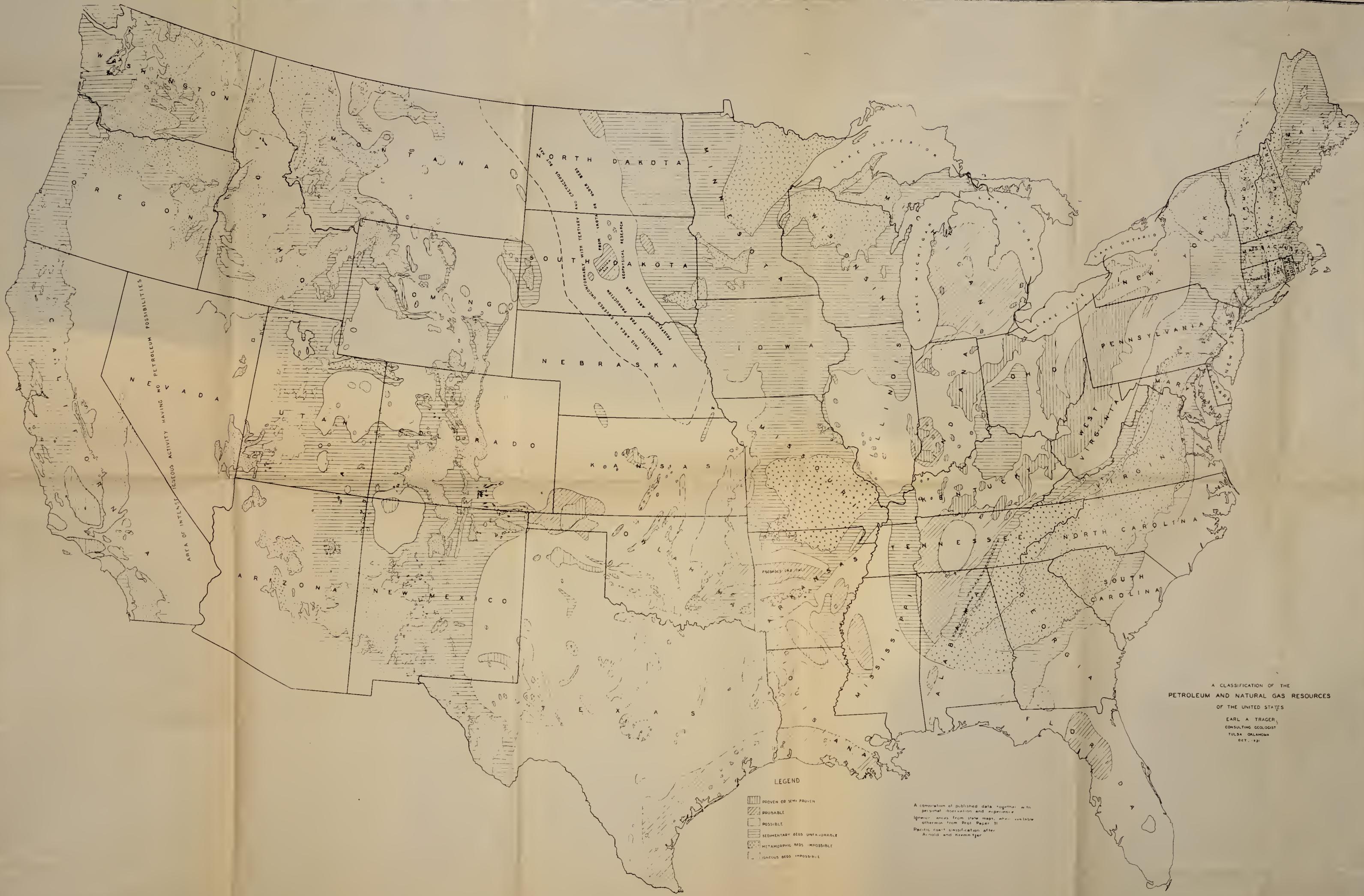
Major field	Classification of land (in square miles)						Total area	
	Impos- si- ble	Unfavor- able	Prospec- tive	Proved				
				Oil	Gas	Total		
Rocky Mountain.....	108,480	202,649	245,158	154	42	196	556,483	
Mid-continent.....	7,814	114,465	401,103	2,102	878	2,980	526,362	
Appalachian.....	15,635	106,155	91,871	3,209	4,762	7,971	221,632	
California.....	58,320	92,373	7,400	203	1	204	158,297	
Illinois-Southwest Independent.....		17,553	47,097	212	61	273	64,923	
Gulf coast.....			62,979	27	4	31	63,010	
Michigan.....	6,865	9,925	41,175	14	1	15	57,980	
Lima-Indiana.....		14,075	33,075	1,116	404	1,520	48,624	
Other.....	413,535	802,504	113,435		4	4	1,329,478	
United States.....	610,649	1,359,699	1,043,247	7,037	6,157	13,194	3,026,789	
Per cent.....	20.2	44.9	34.5	0.2	0.2	0.4	100.0	

^a Petroleum in the United States and Possessions, by Ralph Arnold and William J. Kemnitzer, p. 21, 1931.

⁹ Federal Oil Conservation Board, report to the President of the United States, September, 1926. p. 9.

¹⁰ Arnold, Ralph and Kemnitzer, William J. Petroleum in the United States and Possessions, Harper & Bros. 1931. p. 21.

¹¹ Map entitled "A Classification of the Petroleum and Natural Gas Resources of the United States." Prepared in October, 1931, by Earl A. Trager, consulting geologist, Tulsa, Okla.



Probably only a small percentage of the most likely oil and gas territory will actually produce, but the map tends to confirm the statement frequently made to the investigator that a large part of whatever petroleum may be mined in the future will be mined from lands now being used for agricultural purposes.

Since the technical authorities on the subject fail to agree, it is obvious that the individual farmer who owns a tract of land located in potential oil-producing territory is seriously handicapped in attempting to estimate the value of his royalty rights. But since the area in which new oil fields may be found has been estimated by some authorities to exceed 1,000,000,000 acres, and since all the parties interviewed in the course of this study estimated that (aside from new fields that may be located on publicly owned lands) practically all of the potential oil-producing area is now being used for agricultural purposes, it would seem certain that farmers who have potential mineral rights are decidedly numerous. How large a proportion of the mineral rights underlying farm lands have already been permanently disposed of by the farm owners has not been determined.

Areas believed to have considerable gas-producing potentialities may be equally favorable, and in some instances more favorable, for oil production than is proven oil territory. Examples are the probable gas field that extends across the central portion of Arkansas and the western part of the probable gas belt in Montana. If the classification had been limited to oil probabilities and possibilities, many areas indicated as having production potentialities would have been classified as unfavorable. Many areas classified as probable are located within possible territory because, through regional studies, they were found to have more favorable structure and stratigraphic conditions.

Mr. Earl A. Trager, who made this map, has been engaged in the study of petroleum resources through the Rocky Mountain, mid-continent, and Mexican fields for 14 years. During the last six years much of his time has been devoted to regional studies of petroleum resources for major oil companies. He incorporated in this map the information gained from these experiences. His classification of the Pacific coast area was taken from Petroleum in the United States and Possessions, by Ralph Arnold and W. J. Kemnitzer. He obtained the data concerning the igneous and metamorphic areas from State geological maps and from the United States Geological Survey Professional Paper No. 71, by Bailey Willis. All proven pools of considerable area are accurately outlined, but the smaller proven pools are slightly exaggerated in size to make them evident on a small-scale map.

This map was prepared by Mr. Trager through the courtesy of the Landowners' Oil Association.

PROPERTY RIGHTS TO OIL AND GAS

The right to property in oil or gas or other minerals may, by proper conveyance, be separated and sold as independent of the rest of the land. Unless a specific landowner owns all land over a particular pool of oil or gas, his only method of protecting his interest from being drained away by an adjoining landowner who may drill into the pool is to drill on his own land or to lease or sell part of his oil and gas rights to a producing company that will agree to drill a well within a specified period. Land over known oil pools has already been cut up

into many ownerships. Since the general location, not to mention the limits, of any pool can be determined definitely only after extensive and costly drilling operations, the practice of producing companies and other agencies that operate in the oil business is to scatter their interests over wide areas to reduce the risk. The practice is described by Prof. Leonard M. Logan, of the University of Oklahoma, as follows:¹²

They (the larger oil companies) do not carry all their eggs in one basket. This fact causes a wider diversification of the ownership of oil and gas rights in any one region. A map of any oil region where the land is privately owned will show how the operators "chequerboard" their interests. Rather than put all their chips on one number or on one color, they scatter them over the board: Once oil and gas are discovered the price of leases and royalties increases rapidly and there is a scramble among the operators "to get in on production."

The right to explore for oil and gas on a given tract of land may be secured in the following ways: (1) Purchase of the fee, (2) purchase of the oil and gas mineral rights, (3) lease of the oil and gas rights, and (4) assignment of either one of the above from the previous holder.

The purchase of the fee is usually resorted to where land is cheap and it is as easy to acquire the mineral rights through the outright purchase of the land as it is to lease the land or buy the exclusive mineral rights. Sometimes land may be bought to avoid an exaggerated idea on the part of the landowner of the value of the land if he knew the purchaser desired it for the purpose of exploring for oil and gas. The disadvantages attached to buying the fee is that much land suitable for agriculture would be brought into the control of the oil companies, and since they are not in the farming business they do not care to look after the agricultural possibilities of the land. Another disadvantage in buying the land outright is it takes over the duty to pay real property taxes, which would be an added burden on the oil companies.

As a rule, the producing companies and operators are not interested in buying the royalty rights. A lease can be purchased from the royalty owner for less money. If the well results in a dry hole the prospector is not out so much capital. It is customary in a lease contract to give to the royalty owner a portion of the oil produced. This amount varies in different places. In the Mid-Continent area the customary interest is one-eighth. In the Osage Nation and in California it is one-sixth. There is a sliding scale for royalties on Government lands, depending on the location and quantity of oil produced. Frequently special provisions are made in regard to the royalty payment for gas.

While the lease calls for a certain portion of the gross receipts of oil and gas, the payment is not often made in kind, but all the production from the well is sold and the payment is made in cash.

Since 1920 the business of buying oil and gas royalties has experienced a rapid growth. Large companies have been organized for the purpose of encouraging investments in this phase of the oil business. The average landowner is ignorant of the true value of his mineral rights. He either disposes of them for a nominal sum, especially if he is a farmer and the crops are a failure, or he has an exaggerated idea of their value and often holds his interest too long. The test well proves to be a failure and the value of his royalty drops to nothing. The best plan for the fee owner to follow, under the present system, is to sell off small portions as the demand for royalties increases until he has disposed of one-half and then hold the other for later developments. When fractional royalty interests are sold they are usually undivided interests in the whole tract of the fee owner.

SPECULATIVE FEATURES OF OIL AND GAS INDUSTRY

Lease speculating has long been a well-known phase of the oil business. Brokers, bankers, private individuals in the oil regions, and land departments of some of the oil companies engage in the practice. As the leasing and royalty purchasing agencies do not know in advance whether any one of the tracts of lands leased or bought will prove to be productive, it is common practice to shift

¹² Logan, Leonard M., Jr. *Stabilization of the Petroleum Industry*. 1930, pp. 52-53.

as much as possible of the risk inherent in the industry to the even less informed farmer or other individual landowner. The lease speculators avoid some risk by acquiring leases on many tracts of land at the lowest possible price in the hope that enough oil and gas will be found on one or more tracts to repay richly the cost of all. If no oil or gas is found on any of the tracts, the speculator loses all the money he paid for the leases unless, as in some instances, he has sold part of the leases at enhanced prices because of a speculative flurry in oil leases, usually known as a "play," that has taken place on or near his lands while his lands were being tested.

Unorganized farmers are forced to choose between the risk of getting nothing at all, if they do not lease or sell, and the risk of parting with potential fortunes in exchange for mere pittances if they do lease or sell.

Furthermore, the farmers often become the victims of unfair dealings. A leading oil man engaged in the business of pooling mineral acreage has said, in substance, that the misrepresentations made by a troublesome minority of leasing agents and royalty purchasers are as varied as the human mind can conceive. A few of the more common practices of this class of royalty promoters are here outlined.

The farmers are induced to sign leases that expire within 5 or 10 years unless drilling of a well is started by the last day of the last specified year. The standard form of lease is much fairer to farmers. It provides that unless a well has been started within one year an annual rental of a specified amount must be paid, and that unless a well has been completed by the last day of the 5 or 10 year term, the lease shall automatically expire.

Many cases are on record in which this type of clause in the first-mentioned lease deprived landowners of large revenues that would have been received under standard leases. For example, if the play became more active, or if a gusher well was found on property adjoining the leased property during the last few days or months before the lease expired, all the promoter had to do was to start a well on the leased property; then he could take his time in completing it. In such cases, had the farmers signed the standard form of lease the promoter would not have had time to complete the well. The land would thus have been released and the farmers would have been in position to sell their leases for as much as the market would bring.

Experience has proved that leases often bring \$1,000 an acre bonus after oil has been discovered nearby, in contrast with the very small (or no) bonus, plus the usual nominal sum of 25 cents to \$1 per acre rental, which would have resulted under the first-mentioned lease.

Another unfair practice followed by those agencies who seek to take advantage of uninformed landowners is found in the royalty clause. In the standard form of lease used in the mid-continent field, the royalty provision allows to the lessor one-eighth or other fraction of the oil, one-eighth or other fraction of the gas, one-eighth or other fraction of the casing-head gasoline, and generally, a like fraction of all other minerals. In many unfair leases, the royalty clause provides for one-eighth of the oil, but for only \$50 or \$100, or some other nominal sum (usually not over \$300 a year) for the gas, and only \$50 or \$100 a year for casing-head gasoline. This means that if a gas well is struck, the landowner gets practically nothing compared with what he would have obtained as a one-eighth share, unless the gas

production is extremely low. If an oil well is struck, he gets practically nothing for the casing-head gasoline. The following quotation is taken from a standard form of lease being used in our newest major gas fields—the Tioga County gas field in Pennsylvania and the gas fields in Tompkins and Schuyler Counties, N. Y.

In consideration of the premises, the said lessee, covenants and agrees to deliver to the credit of the lessor, as royalty, free of cost, in the pipe line to which the wells drilled by the lessee may be connected the equal one-eighth part of all oil produced and saved from said leased premises, or at the lessee's option to pay to the lessor an amount equal to the market price of such one-eighth royalty oil based on the market price for oil of like grade and gravity prevailing on the date such oil is run into the pipe line or into storage tanks.

If gas only is produced, the lessee agrees to pay as royalty \$200 each year, payments to be made quarterly, for the gas from each gas well drilled on said premises the product from which is marketed and used off the premises, or which the lessee elects by payment of royalty to treat as a producing well.

Lessor may lay a line to any one gas well on said lands and take gas produced from said well for use for light and heat in one dwelling house on said land, at lessor's own risk, subject to the use and the right of abandonment of the well by lessee. The first 100,000 cubic feet of gas taken each year shall be free of cost, but all gas in excess of 100,000 cubic feet taken in each year shall be paid for at the current published rates of the lessee in the town nearest the premises above described, lessor to lay and maintain the service line and furnish regulators and other necessary equipment at his own expense. This privilege is upon the condition precedent that lessor shall subscribe to and be bound by the reasonable rules and regulations of the lessee relating to the use of free gas, and shall maintain said service line, regulators, and equipment in good repair and free of all gas leaks and operate the same so as not to cause unnecessary leaks or waste of gas.

This lease shall continue in force and the rights granted hereunder be quietly enjoyed by the said lessee for a term of 20 years and so much longer as oil or gas or their constituents is or are found on said premises in paying quantities in the judgment of the lessee; provided, however, that if at the termination of the said term either primary or extended there is a well in process of being drilled, then this lease shall continue in force so long as the drilling of such well is continued with reasonable diligence, and so much longer thereafter as oil or gas or their constituents is or are found on said premises in paying quantities in the judgment of the lessee.

Another common practice of certain unfair lease and royalty brokers is to offer farmers a stipulated amount for a lease covering a specified period of years, bearing a rental of 50 cents to \$1 per acre annually, plus one-half of the royalty rights. These brokers then return to the lease market centers and, if possible, sell the leases for all they paid the landowner for the lease and one-half the royalty, themselves retaining the one-half royalty interest. If a broker is unable to sell a lease, he does not pay any rental the second year and the agreement is so worded that the lease is then lost, but the broker retains title to one-half of the royalty rights. In many instances, these brokers have led farmers to believe that they are simply signing leases in duplicate and not selling any royalty rights. This practice is fraudulent on its face and, according to oil operators in the mid-continent area, many suits to set aside these royalty conveyances are now pending in the courts. Such brokers seem to continue the practice because they know that most farmers have not the financial resources nor the information with respect to the oil industry to take their cases to court, if they do finally learn that they have been tricked.

Another very common practice of unscrupulous agencies is to get the farmer landowner to sign a lease on condition that the lease be deposited in a local bank. The farmer is authorized to draw on the

lease broker, on sight after 60 days, the amount stipulated in the lease. In this way the broker ties up the farmer's land for 60 days. If he is able to sell the lease at a profit within that period, the farmer is paid; otherwise, the lease is returned and the farmer has lost his opportunity to lease his land owing to the termination of what is called "the lease play."

The farmer not only is the victim of unscrupulous promoters, but he is quite as often the victim of his own lack of knowledge. He has no advance information as to when a play will start. Many farmers sell a part of their mineral rights for nominal sums just before drilling is begun.

It is an established fact among oil operators that during recent years the big money in royalties, particularly in the newer fields, has been made by others than the landowners, and that, as a class, farmer landowners have benefited far too little from their mineral rights. Even when dealing with honest operators this may occur. For example, an oil play may last only a few weeks or it may take several years to develop. A farmer who is experiencing difficulty in maintaining his equity in his property, because of crop failure, low prices for farm products, or other reasons, is tempted to sell his royalty rights at the first opportunity. He is not in position to profit by the fact that under proper organization and direction he could safely capitalize his mineral rights, and figuratively speaking, engage in "two-dimension" farming. As a consequence, even if his royalty is not practically lost to unscrupulous agencies, it gets into the hands of buyers and scouts for large royalty companies at a nominal price before drilling operations are begun and before such royalty rights begin to bring high prices on the market. If a farmer is in position to retain his mineral rights, he will find that their value increases as the test well nears completion. The test well may come in as a producer or it may prove to be another dry hole. If it is a dry hole the owner of the lease discontinues payment of rentals. If it is a producer the royalty values in the vicinity get a big play.

But as the oil or gas reservoir has definite boundaries, the farmers who hold royalty rights are still facing a chance that is not taken by the lease owners. These owners operate only after they have reduced their risk by acquiring all land in a particular block, or a big spread, or a checkerboard, over large areas of potential producing acreage.

The peculiarity of the petroleum industry places the individual landowner at a serious disadvantage. If he fails to lease his land, and if he wants results, he is forced to finance costly drilling operations¹³ on his own land and to take the chance of not locating a producing well. Without money of his own it is next to impossible for him to get a financing agency to risk its money on one tract of land.

Potential mineral acreage has a speculative market value which fluctuates according to its proximity to actual development and to the attention given it by producing groups. If a farmer leases his land he

¹³ "The cost of drilling ranges from a few hundred dollars for some of the shallowest wells in the East to nearly \$500,000 for some of the deepest wildcats of the West, but the average cost of all wells up to Jan. 1, 1929, was less than \$12,000 each. The average cost of wildcats wells ranged from \$5,326 in the Lima-Indiana field to \$43,335 in the California field, and averaged \$19,410 for the country as a whole. The average cost of proved-area wells ranged from \$3,405 for Lima-Indiana to \$40,239 for California, averaging \$11,190 for the country as a whole. Deep wells are costly to drill, even in proved areas. Wells to below 7,000 feet in the California fields commonly cost more than \$200,000. On the other hand, wells less than 2,000 feet in the eastern fields rarely exceed \$5,000." (Petroleum in the United States and Possessions, by Ralph Arnold and William J. Kemnitzer, 1931, p. 28.)

is at a further disadvantage because he can not always compel the drilling of offset wells on his land while the oil or gas is being drained from under his land through neighboring wells. Unless he has the advantage of organized bargaining, under existing conditions, the only way in which he can be sure to realize anything from his mineral rights is by selling them outright to well-informed persons who are farsighted and discerning enough to acquire large spreads of such rights in the path of development and who can afford to assume the risks involved.

It is apparent, therefore, that the average individual farmer in an area that may eventually be very productive has but small chance to get any cash returns of consequence unless he is in a position to have his potential royalty interests effectively managed. This emphasizes the need for organization to secure and manage effectively the mineral rights of farmers.

EVOLUTION AND RESULTS OF OSAGE INDIAN COOPERATIVE MINERAL RIGHTS POOL

The Osage Indian mineral rights pool is the classic example of successful cooperation in the pooling and management of potential mineral resources. The States of Texas and Oklahoma, in the management of State-owned lands, provide other examples of pooling mineral rights that have proved successful. But since the Osage pooling plan embodies the best features of the other pooling plans, the methods of only this pool will be outlined.

The Osage Indian Reservation, located in Osage County, Okla., consists of 1,470,549.04 acres, of which 1,465,350.51 acres had been allotted by June 30, 1931. In 1896, when the Federal Government announced its intention to allot to individual members of the tribe, the lands which, until then, had been held in common, many saw in this allotment plan an opportunity to acquire mineral rights in regard to which the majority of Indians were uninformed.

One of the far sighted members of the tribe, John Palmer, developed the idea that unless steps were taken to reserve mineral rights under lands subject to allotment, the majority of the members of this tribe might lose vast potential mineral wealth to outsiders. He argued that only the surface rights of the land should be allotted and that, since no one knew where oil or gas or other minerals would be found, it was unfair to divide potential mineral wealth until it had been mined. He is said to have argued that "he who takes less than his share of the tribal wealth is a fool and he who takes more is a thief."

Vice President Charles Curtis, then a Representative in Congress, was appealed to and at his instance Congress passed a bill which effectively secured the mineral rights to, and equitably distributed the proceeds from such rights among, the 2,229 members of the tribe.

The act of Congress approved June 28, 1906, entitled "An act for the division of lands and funds of the Osage Tribe of Indians," provides, under section 3 thereof, "That the oil, gas, coal, and other minerals upon said allotted lands shall become the property of the individual owner of said land at the expiration of 25 years from April 8, 1906, unless otherwise provided for by act of Congress, and leases for such minerals may be made by the Osage Indians through their Tribal council with the approval of the Secretary of the Interior under

such rules and regulations as he may prescribe, the royalty to be paid to the Osage Tribe under any mineral lease so made shall be fixed by the President of the United States and disbursed to enrolled members, or their heirs, per capita, at stated intervals after deducting expense of supervision and office maintenance.”¹⁴

This act of Congress made it possible for the Osage Indians to benefit from desirable lease and drilling contracts which they might not have received without organization. One of the rulings provided that one-sixth of the oil royalty must accrue to the Osage Indian Tribe for wells on any quarter section or fractional quarter section of land which produces less than an average of 100 barrels daily for a calendar month, and one-fifth oil royalty must accrue if average production is more than 100 barrels.

When two concerns applied for 300,000 acres for gas leases, the Secretary of the Interior directed that oil and gas technologists from the United States Bureau of Mines make investigations in the oil and gas fields to determine desirable terms of leases. Public hearings were held to get the viewpoints of prospective lessees. On the basis of these investigations and hearings the rate of 3 cents per thousand cubic feet of gas was determined to be a fair rate.

Gas leases being used to-day provide that where gas is used for extraction of gasoline, a specific royalty must be paid on gasoline so produced, and that the gas not used for such operating purposes must be sold, and of the amount sold, the stipulated royalty of 3 cents per thousand cubic feet must be paid.

Prior to 1916, when this new rate was first established, the Osage Indian Tribe received approximately \$12,000 per annum as gas royalty, whereas under the new arrangement, at 3 cents per thousand cubic feet, the royalty for the first year was approximately \$798,000. Gas leases provide for change in royalty at the end of 5-year periods; and, at the expiration of each such period, the Department of the Interior causes a further investigation to be made.

Up until November 9, 1918, oil and gas leases were sold for cash; after that date regulations were modified to permit payment of 25 per cent on the day of sale and the balance within three years from the date of the approval of the lease, with interest at 5 per cent. On February 2, 1922, the terms of sale of oil leases were further modified to permit lessees, on “producing leases” (leases on land actually producing oil), to mortgage drilling equipment and to secure notes given to cover deferred payments of lease bonuses. The policy of permitting lessees to mortgage producing leases as security for notes was rescinded on April 26, 1929. Now only two classes of security are acceptable—Government bonds and corporate surety.

The Annual Report of the Osage Indian Agency for 1921 stated that oil produced in the Osage field was being purchased by 15 companies, a number of which paid a premium of 10 cents to 40 cents over posted market prices for oil produced in mid-continent field.

On July 7, 1922, the Department of the Interior ruled that thereafter, when settling for oil, the price demanded and received should be the price at which not less than a majority of the oil of similar

¹⁴ By congressional amendments to the act of 1906 approved Mar. 3, 1921, and Mar. 2, 1929, the period for which the potential minerals referred to were reserved to the tribe was extended to Apr. 8, 1946, and Apr. 8, 1958, respectively.

gravity had sold for during the period in question in the mid-continent field.

Oil and gas leases now provide that before beginning operations lessees shall pay the surface owner \$100 for each well located on cultivated land or land suitable for cultivation, and \$35 for each well located on land not suitable for cultivation. If the location site exceeds 1½ acres in area additional charges are made. Lessees are also liable for all damage to crops and improvements, and for all other damage occasioned by operations. An act of March 3, 1921, permits surface owners, if dissatisfied with damages granted, to appeal to courts without the consent of the Secretary of the Interior.

Leases require a lessee to drill one well to Mississippi line (or lesser depth if oil is found in paying quantities before that geological stratum is reached), within 12 months of date of approval. In case equipment can not be obtained, the Secretary of the Interior may extend the time for payment of annual rental of \$1 per acre for each year's delay. On January 15, 1921, the Department of the Interior issued an order permitting suspension of drilling in unproven areas in consideration of a payment of \$1 per acre per annum.

On June 30, 1931, according to the annual report of the superintendent of the Osage Agency, there were 9,695 producing oil wells and 437 producing gas wells on the reservation, in addition to 3,201 abandoned wells and 2,937 dry holes. The fact that 2,937 wells, or 18.1 per cent of all wells drilled to that date, were dry holes indicates that the nature of operations on the reservation was no less speculative than on other potential producing areas owned by farmers.

As a consequence of effectively pooling their mineral interests in 1896, the 2,229 members of the tribe (or the heirs of each taken as a group) shared equally in the total of \$241,546,289.82 received from all oil and gas sources up to June 30, 1931. (Table 3.) The efficient management of their pooled mineral interests suggested by the extremely desirable terms of leases sold to private oil operators is emphasized by the fact that \$109,902,384.70, or 45 per cent of the total income from all oil and gas sources, was obtained in bonuses (money paid in addition to nominal rental fees for the right to lease land). In fact, bonuses paid amounted to slightly more than the total of all oil royalties (\$109,795,553.97). Without the collective-bargaining power made possible through adequate cooperative organization, there is slight question but that the bonuses would have totaled only a nominal sum.

The exact cost to the Federal Government agencies of managing the pooled rights of the Osage Indian Tribe is not known. According to figures made available by the superintendent of the Osage Agency, more than 97 per cent of the total proceeds from pooled mineral rights has been distributed among or reserved for the 2,229 Osage Indians or their heirs.

TABLE No. 3.—*Income received by the Osage Tribe of Indians from all oil and gas sources since the first discovery well on the reservation in 1901 through the fiscal year ended June 30, 1931*¹

June 30—	Oil royalty	Gas royalty	Bonus	Interest on bonus	Rentals	Total
1901	\$553.25	\$50.00				\$603.25
1902	398.26	50.00				448.26
1903	2,932.71	25.00				2,957.71
1904	9,551.24	162.50				9,713.74
1905	128,268.42	628.70				128,897.12
1906	227,290.32	977.02				228,267.34
1907	298,378.40	3,202.08				301,580.48
1908	243,610.36	3,185.50				246,795.86
1909	245,300.00	2,713.53				248,013.53
1910	231,093.52	2,897.95				233,991.47
1911	514,539.66	3,151.55				517,691.21
1912	652,734.55	3,441.92	\$39,436.00			695,612.47
1913	773,982.19	4,318.03	498,182.58			1,276,482.80
1914	1,351,271.71	7,120.37			\$1,581.27	1,359,973.35
1915	538,377.52	10,841.60			12,591.06	561,810.18
1916	979,685.01	123,996.77	2,064,300.00		30,338.00	3,198,319.78
1917	2,622,145.27	803,639.73	1,662,480.78		108,325.49	5,196,591.27
1918	3,805,489.28	807,717.16	4,824,942.39		94,901.21	9,533,050.04
1919	4,581,733.33	838,941.38	5,447,752.44		130,950.31	10,999,377.46
1920	8,079,778.46	972,763.32	8,611,874.72	\$87,726.72	114,094.37	17,866,237.59
1921	10,267,544.34	1,041,201.86	6,044,938.31	281,898.92	119,324.84	17,754,908.27
1922	8,542,989.93	692,701.87	11,613,401.60	401,117.57	117,773.45	21,367,984.42
1923	13,048,877.86	1,023,663.75	15,671,403.98	652,472.74	106,082.07	30,502,500.40
1924	10,776,366.01	1,103,189.14	11,804,103.89	835,322.08	151,561.00	24,670,542.12
1925	9,793,164.73	1,351,420.10	14,577,607.18	969,893.37	163,923.50	26,856,008.88
1926	8,845,235.12	1,504,629.60	10,603,688.84	938,850.38	131,183.43	22,023,587.37
1927	9,016,825.60	1,370,012.01	8,112,103.06	340,667.71	140,659.19	18,980,267.57
1928	5,050,418.41	1,081,131.94	5,220,778.57	116,821.84	86,427.96	11,555,578.72
1929	3,857,778.54	1,068,109.57	2,338,730.00	87,962.17	88,679.27	7,441,259.55
1930	3,310,200.24	865,473.24	658,911.61	15,672.25	109,810.67	4,960,068.01
1931	1,999,039.73	622,514.78	107,748.75	2,839.67	95,026.67	2,827,169.60
	109,795,553.97	15,313,871.97	109,902,384.70	4,731,245.42	1,803,233.76	241,546,289.82

¹ Report dated Aug. 29, 1931, from D. D. Murphy, Superintendent Osage Indian Agency, Pawhuska, Okla., to the Commissioner of Indian Affairs, Washington, D. C. (Narrative section of the annual report for Osage Indian Agency for the fiscal year 1931.)

ADVANTAGES OF COOPERATIVELY ORGANIZED EFFORT

There are many differences between the situation of the Indians as wards of the Government and the situation of the farmers who own potential petroleum resources, but it is believed that the general idea of cooperative pooling of mineral rights developed by the Osage Tribe can be adapted to meet the situation of farmers who own potential petroleum resources. Through the proper type of pooling organization the average farmer may derive many benefits which would not accrue to him without organization.

Collective bargaining power obtained from such organization should bring the farmer better lease terms and drilling contracts, as a result of which he would obtain higher bonuses, rentals, and royalties. In this way he would liquefy what otherwise, to him, is a frozen asset. By so doing he would place himself in a position to receive a more or less steady income from pooled mineral rights. With his mineral rights secured in a cooperative pool, the farmer would have a business stake in the natural resources of the country upon which he could realize an income in much the same manner as does a large royalty corporation that has millions back of it.¹⁵ Whether this income may be

¹⁵ The term "mineral rights" in the remaining parts of this report refers to rights of potential petroleum resources, unless otherwise indicated.

smaller or many times larger than the income he receives from any crop, or crops, grown on the surface of his farm, he will have assurance that the subsurface as well as the surface of his farm is working for him. He will also be insured against losing his mineral rights to unscrupulous agencies and will be more likely to obtain equitable compensation for these rights.

Authorities in the oil and gas industry who were interviewed during this study unanimously agree that cooperative pooling of potential mineral-producing acreage holds many advantages for pool members. Briefly, a cooperative pooling organization providing adequate safeguards will do for the landowner what the lease pooling plan does for the oil operator—namely, enhance the probability of favorable results.

To the question, "In what ways or under what conditions can the average individual farmer-landowner benefit more by not pooling or by pooling his mineral rights in an assumed sound cooperative pool?" A written answer was requested from several geologists and from others familiar with the petroleum business in the mid-continent oil area. Three representative answers are here given:

(1) Speaking from 20 years' experience as a geologist, oil operator, and landowner in the State of Oklahoma, I can not think of a single condition under which the average landowner can fail to benefit by pooling his interest in a sound cooperative pool. With a single farm he has all his eggs in one basket, and an oil pool of large size may be developed within sight of his farm and yet he gets none of the proceeds. Fence lines very often mean the difference between poverty and wealth from the mineral values on the farms. Safety in pooling a portion of individual interests is more or less assured in the long run. The farmer always retains, if he so desires, a portion of his own royalty to deal with as he sees fit and he can not fail to gain tremendous advantages over farmers who do not pool a part of their interest by joining in such an arrangement.¹⁶

(2) I strongly approve of the principle of pooling acreage for oil and gas production, provided the following points are taken care of: (a) That the farmer is entirely protected in his legal relationship with the pooling organization; (b) that the pooling organization is honestly and efficiently managed; (c) that geological services be employed and that the geologists are well-trained men.

My reasons for approving the pooling plan in principle are: (a) The business affairs of the farmers in dealing with the oil companies will be handled by men trained in that work; (b) it will lead to more efficient drilling of proven territory; (c) the landowner's income from oil and gas production will be spread over a very much larger group of farmers than is the case when each farmer acts individually.¹⁷

(3) My convictions are so strong because of the advantages of cooperative pooling by landowners in a given area that I do not know of any advantages the individual landowner may have by not pooling.¹⁸

Petroleum appraisal engineers recognize in their appraisals that thousands of tracts of land in the potential mineral-producing belts have little or no market value as separate units but have great value when pooled or held in a large spread by common ownership and management. The basis for this reasoning develops from the fact that geologists and oil and gas mining engineers are unable positively to locate unmined oil or gas without the drill. A large spread of acreage in a general oil and gas belt, therefore, has an average market value per acre that is greater than any particular tract would have.

¹⁶ Dr. Irving Perrine, former professor of geology at the University of Oklahoma and now chairman of the oil and gas division of the Oklahoma City Chamber of Commerce and a director of the Kansas and Oklahoma royalty division of the Mid-Continent Oil and Gas Association.

¹⁷ Mr. Kenneth K. Landes, professor at the University of Kansas and assistant State geologist, State Geological Survey of Kansas.

¹⁸ Mr. Leonard M. Logan, jr., associate professor of economics, University of Oklahoma, and author of Stabilization of the Petroleum Industry.

Pooling increases the market value of mineral rights in a way analogous to that in which fire insurance increases the value of individual buildings. Whatever may be the normal probable ratio of the number of producing tracts to the total number of tracts—for instance 1 to 20—the ratio will be more nearly realized, in the long run, if many tracts are considered. Likewise any given deviation, such as a deviation of 25 per cent, from such a probability, will be much less likely on pooled tracts than on an individual tract. The individual farmer, by pooling, substitutes a more stable for a less stable potential income, both having the same long-time mathematical value. Considering the common recognition of the fact that the average performance of many similar items is much more nearly uniform than is the performance of one or a few individual items, no demonstration of that fact is attempted here.

One other reason for the greater value of a spread of acreage over a similar total acreage owned and held as separate units is that the spread can be leased for development purposes more advantageously. If farmers should pool their mineral rights, the major oil companies, which now acquire spreads through direct contact with farmers, would get their spreads from the farmers' pool. In fact, the mere pooling of potential producing lands which have no value as individual tracts creates value because such individual tracts become part of a spread which one or more operating companies may want.

There is no accurate method of appraising the ultimate value of mineral rights in "wildcat" acreage. In general, one might say that mineral rights in "wildcat" acreage are valueless unless, or until, a demand for them develops. The fact that the pooling of such mineral rights does create a value that did not previously exist is suggested by available figures concerning the appraised value, as of September 30, 1930, of acreage accepted by five royalty pools operating in the mid-continent oil and gas field. No acreage in these pools was producing oil or gas at the date of the appraisal by Huntley & Huntley, petroleum geologists and engineers, of Pittsburgh, Pa. When pooled during the previous four years the acreage was "wildcat" acreage. The value of these mineral rights before they were pooled is not known. On September 30, 1930, however, the average per-acre value of the 287,496.68 acres pooled was appraised at \$15.32. The average appraised per-acre value for the five individual pools varied from \$6.17 to \$28.14. (Table 4.)

TABLE 4.—Appraised value of acreage in five royalty pools, September 30, 1930¹

Pools	Number	Appraised value	
		Total	Per acre
Panhandle Cooperative Royalty Co.	45,161.98	1,271,044.78	28.14
Farmers' Union Cooperative Royalty Co.	48,089.26	1,043,281.57	21.69
Texas-Osage Cooperative Royalty Co.	118,972.35	1,305,295.28	10.97
New Mexico-Osage Cooperative Royalty Co.	31,623.43	195,189.07	6.17
The Kansas Farmers' Union Royalty Co.	43,649.66	589,636.04	13.51
Total	287,496.68	4,404,446.74	15.32

¹ Appraisal made by Huntley & Huntley, petroleum geologists and engineers, Pittsburgh, Pa.; figures obtained from photostatic copies of unpublished report of said company to Flag Oil Corporation, Oklahoma City, Okla., dated Jan. 15, 1931.

Since farmers own a large part of the potential petroleum-producing acreage of the country, pooled mineral rights might well become an important farm asset, comparing favorably in some localities with crops and livestock. The nature of the petroleum industry is such that even an unmined potential supply may become of great value as a definite farm asset before any oil, gas, or other mineral is produced. For example, the large oil companies (realizing that new fields must be found to take the place of declining fields and that these new fields can not be delimited or even located definitely in advance of drilling) lease and release from time to time large areas of what is called "protection acreage." These companies sometimes pay bonuses of 10 cents to \$1 per acre, besides the annual rentals, for the privilege of deferring the drilling of test wells on these lands until the leases are surrendered. Thus, a certain farmer might receive a rental for his land for a year or two, and then later the lease might be surrendered so that the land would not bring any further rental for some time, if at all.

When, by means of effective leadership through a pool, the income from rentals, bonuses, and royalties has become as large and regular as possible, mineral rights may be counted a fairly dependable farm asset. In other words, by assembling potential petroleum-producing acreage in cooperative pools, the farmer, figuratively speaking, extends the point of his plow to the development of his subsurface wealth.

Assuming that a sound cooperative pooling program in the United States materializes, the farmers of the country, through trained leadership, will be in a position to make a substantial contribution toward facilitating a constructive program of conservation for the oil and gas resources of the country.

The primary and most important cause, both of the failure to recover the full recoverable proportion of the oil content and of production at recurring periods out of all proportion to the demand, is not far to seek and is the same. It consists in the law governing the right of the owner of land to recover oil from it. The law is that the owner of land has the right to recover from his land all the oil that can be produced therefrom, regardless of whether that oil was originally in place in his ground or has been caused to flow from the ground of others by his action in opening and operating a well on his property. There is no property, in the strict sense, in the oil until it is recovered any more than there is in underground water, and the oil belongs to him who first gets it. The result is that when an oil field is once opened, it is a race between all the owners in the field to recover all each can. It is a race in which they must take part, willy-nilly, or else lose what otherwise they might obtain. It is a race which can be avoided only by the joint action of every one in the field.¹⁹

To avoid waste in the mining of oil and gas and to conserve these resources properly, the United States Department of the Interior, the Federal Oil Conservation Board, the Mid-Continent Oil and Gas Association, and possibly other agencies have advocated for several years, and are still advocating, a plan known as unitization. By unitization is meant the process by which divided interests in an oil or gas reservoir that contains a number of tracts of land are converted into undivided interests in the entire area. Under such a plan the owner of gas or oil rights in an individual tract or in tracts of land, surrenders his exclusive ownership thereof in return for an assignment to him of an undivided interest in the oil and gas rights of the reservoir

¹⁹ Report III of the Federal Oil Conservation Board to the President of the United States, Feb. 25, 1929 p. 11.

as a whole. The purpose of the plan is to develop and operate the area over the reservoir as one property or unit through the instrumentality of a common agent. This would prevent unnecessary competitive drilling and waste and at the same time would secure greater recovery at less cost.

Since the principal obstacle to the adoption of a unitization program is resistance to collective ownership and management after the oil or gas reservoir has been discovered, it is obvious that centralized control of large spreads or blocks of land, brought about through cooperatively pooling of mineral rights, is more conducive to orderly development than is highly competitive diversified ownership. Officials of two or three or more cooperative mineral acreage pools could easily agree upon an operating program and upon a division of the proceeds that might be derived from a particular oil or gas reservoir, whereas it would be extremely difficult to obtain agreement among all unorganized landowners. The lack of understanding of all the complicated phases of a unitization agreement plan would tend to make the individual farmer suspicious, and would handicap him in obtaining the desirable terms which trained leadership could obtain for him.

SUGGESTED PRINCIPLES AND PRACTICES FOR FARMER'S COOPERATIVE POOLS

Further study of practices and possibilities of pooling organization representing privately owned lands, is necessary before the subject can be discussed with any finality, but a few suggestions or tentative conclusions may be ventured. Such suggestions as are made here refer specifically to so-called "wildcat" acreage that is not under lease.

Land now under lease may not prove to be any more productive than land not leased, but the owners of the former are likely to consider their land as having greater oil possibilities than land that has never been leased. It would seem that some equitable pooling plan might be developed to take care of the tens of thousands of acres on which the leases will soon expire, and which farmers would otherwise refuse to pool. No special attempt is made in this report to develop this phase of a pooling program.

1. COOPERATIVE PROVISIONS

When possible, it seems desirable to organize pools under the cooperative laws of the State.

Article XI, section 160, of the corporation laws of Oklahoma, for example, provides that—

Ten or more persons may form a corporation for the purpose of conducting an agricultural, dairy, livestock, irrigation, horticultural, mercantile, mining, manufacturing, mechanical, or industrial business upon a cooperative plan, and with their associated successors and assigns may become and be a body politic and corporate by complying with provisions of this act. (S. L. 1923, ch. 167, sec. 1.)

By placing the mining business on the same basis as agricultural and various other businesses, the State of Oklahoma has made it possible for farmers to market their potential mineral resources as well as their field crops through cooperative organizations. Time has not permitted the examination of laws of all States in which potential

petroleum resources are located, but in States in which existing laws do not provide the essential legal basis for pooling mineral rights, steps might be taken to encourage the enactment of desirable legislation. If certain States, in which farmers wish to organize pools, have no specific laws pertaining to such pools it may yet be possible by proper articles of incorporation or trust agreements to create such organizations under the laws of these States.

2. RETAINING POOLED MINERAL RIGHTS

In no case, except possibly by majority or two-thirds referendum vote of all certificate owners, should officials of a pool or any other person, be authorized to sell pooled mineral rights. Under special circumstances it might be advisable to sell all or part of the pooled mineral rights, but the ultimate success of any pooling arrangement that will be satisfactory to the landowners will usually require that no part of any pooled mineral rights may be sold. A safeguard of this kind gives the farmer assurance that he will not be sold out unwisely or dishonestly as to his pooled interest in a good producing tract. To avoid any questions as to the legality of restricting the right of the pool officials, the pool members, or any other person connected with the pooling program, to sell any part of the pooled acreage, it might be necessary to embody this restriction in the mineral deed required from each landowner before he becomes a member of a pool.

3. LIMITING ACTIVITIES OF POOLS

It does not seem desirable to grant authority to the management of the pool or to anyone connected with the pool, to engage in production, processing, or distribution activities on pooled land at the expense of pool members. Such activity is costly and hazardous. It has been said that "mineral rights are the gold bonds of the oil business." Therefore, the assembling of these rights for purposes of collective bargaining with producing companies should never be jeopardized through engaging in the highly speculative aspects of the oil business. Many unexpected things occur in the production, refining, and marketing of petroleum and its products, and these may prove too costly to be borne by the landowners who have pooled their mineral rights. Such landowners are not usually justified in undertaking these risks when they already own the most reliable asset in the oil business.

4. BY-LAWS AND ARTICLES OF INCORPORATION

To prevent unwarranted manipulation or amendment of the articles of incorporation and by-laws, these articles and by-laws might contain the following features:

(a) Require a majority, two-thirds, or some other substantial affirmative referendum vote by the membership, if articles of incorporation and by-laws are to be changed.

(b) Permit the issuance of stock certificates or headrights representing a proportionate share in proceeds of the pool only on the basis of acceptance by the pool of a definite specified acreage of potential petroleum-producing land. Such a provision may be neces-

sary to prevent, in so far as is possible, the watering of the stock and the dilution of the individual's interest in the pool.

(c) Limit the number of voting shares of stock that any one individual or agency may own at any one time to 10, or some other stipulated number, in order to prevent any one party from gaining too great a degree of control in the affairs of the pool. Otherwise, allow each shareholder only one vote regardless of the number of shares he owns. Yet another method of avoiding or discouraging attempts at control by one or a few members is to limit the pro rata share of proceeds that any one individual or agency may collect.

5. PERCENTAGE OF MINERAL RIGHTS TO BE POOLED

It does not seem desirable for farmers to pool all of their mineral rights. Any pool member who is fortunate enough to own land under which oil or gas is located should receive a larger share of proceeds than do other members of a cooperative pool whose pooled acreage may be barren.

If he pools, let us say, an undivided interest,²⁰ and if oil or gas is found on his land, the half interest that he retained would possibly bring him greater profits than would be true if he did not have the increased bargaining power through his pool officials. The assumption here is that a farmer landowner, by pooling an undivided half interest, receives without extra cost, the benefits of expert management for the undivided half interest that he still holds as his individual property. By granting the pool officials power of attorney to lease, and to obtain desirable drilling contracts and other business details for the half interest retained as well as for the half pooled, both the individual farmer and the pool interests probably benefit more than would be true if the farmer retained authority to lease or sell any part of his mineral rights. To avoid mismanagement of their interests the pool members might grant power of attorney, subject to recall at any time, to the pool officials they themselves elect.

Without an arrangement whereby the undivided half interest not pooled by the farmer, is managed by representatives of the farmers, there is a possibility of losing desirable leases and drilling contracts, because it is almost always necessary to obtain the signature of all parties who own undivided interests in a tract of land before any drilling company will expend funds in drilling a test well.

6. POOLING IN RELATION TO FARM MORTGAGES

If all mineral rights are pooled, the farmer may have difficulty in obtaining or renewing a farm mortgage on desirable terms. Farm mortgage agencies, however, would seem to have little or no basis for not accepting or renewing mortgages on land when an undivided half royalty interest is pooled with the safeguards hereafter suggested.

If oil, gas, or any other mineral is located on a tract, the income to the farmer for the undivided half interest would probably be more than sufficient to make any farm mortgage safe. On the other hand, if the land is barren, the fact that a prorata share in proceeds from

²⁰ An undivided interest means that the owner thereof receives the specified proportionate part in all income from mineral rights regardless of where minerals are discovered on this particular tract of land described in the conveyance.

other pooled lands is attached to the farm itself actually makes the land more valuable and therefore more security, rather than less security, to a farm-mortgage agency. If this is not true, the basic reason for promoting the development of cooperative mineral pools is not sound. To assume that a cooperative mineral rights pool, properly organized and managed, will not benefit the farmers is to say that each of the thousands of farmers who own potential oil and gas resources is capable of managing the rights to such resources more efficiently than is a staff of experienced men who devote full time to this work. No statistical evidence is available to substantiate or disprove that assumption, and such an assumption is not in line with the statements made to the writer by every operator in the mid-continent oil and gas area who was interviewed during this study. Furthermore, such an assumption would appear to be equivalent to saying that the general practices of land departments of the large oil companies as well as of other agencies that deal in mineral rights are not sound, because these agencies almost invariably buy or lease spreads of acreage on the same basis that acreage would be accepted by cooperative pools.

Adequate security for a farm mortgage must include assurance that the mortgage debt will be repaid if the surface of the land is destroyed by mining operations before the full amount of the mortgage has been repaid. If oil or gas is being produced from a particular tract of land there is little or no probability that the owner will fail to meet payments due on his mortgage and protect title to his land in other ways. If we assume, however, that the life of the mortgage is 20 or 30 years; that the surface of the land may be destroyed for farming purposes by the end of, let us say, 10 years; and that no more oil or gas will be produced from the land after, say, the tenth year, the economic incentive for continuing to meet interest and possible amortized payments on mortgage debt would have been removed after the tenth year and, under ordinary conditions, the mortgage company might lose all or part of the outstanding mortgage debt.

The possibility that much, if any, loss will accrue to any mortgage company because an undivided half interest in mineral rights is pooled is rather remote even without a special proviso in the plan to guard against such loss. Under the most promising conditions only a comparatively small percentage of all pooled acreage proves to be productive. Regardless of this fact, no farm mortgage company can afford to ignore the possibility of loss, nor does it seem probable that a sound pooling organization can be developed without protecting the mortgage company against possible loss. If such a protective measure does not exist, it is probable that farm mortgage companies will protect themselves by reducing the amount of the loans they would otherwise make on the farms owned by pool members.

By giving full protection against loss to the farm-mortgage company under the conditions described, pool members should be in position to obtain even larger farm-mortgage loans than are nonmembers who own farms that would otherwise have the same loan value. The pro rata share in income from, let us say, 1,000 tracts of land, whether oil or gas is located on any land in the pool, would give farm-mortgage companies greater assurance that mortgage payments will be paid when due.

There are many ways in which the mortgage company could be protected against loss in case oil or gas were located on a particular tract of land in the pool.

One way might be to include in the mineral deed signed by the farmer, a proviso making it obligatory on the part of pool officials to set aside a specified percentage of the pro rata share of income due any pool member on whose land oil or gas is being mined, to pay off any existing mortgage on the surface of the land.

Another plan might require the farmer who wishes to become a pool member to sign a similar agreement or contract with respect to the undivided half interest in mineral rights on his farm which he retains for himself.

In either case, if oil or gas is mined from any tract of land, the royalty from an undivided half or even quarter interest is likely to be more than enough to pay off any reasonable mortgage debt on the surface of the land. In fact, if the income is not large enough to repay the mortgage debt several times it is not probable that much of the surface will be destroyed for farming purposes. The percentage of income to be set aside for repayment of the mortgage debt could be made to vary according to a conservative estimate of the life of the wells, the extent of surface being destroyed for farming, and the amount of the mortgage debt.

A third plan might not only subordinate to the existing first mortgage on the land an equitable share of proceeds to pool members who own the farms on which the surface is being destroyed by mining operations, but also might create a small fund by setting aside a percentage of all income to pool members whether or not the surface is being destroyed by mining operations. This action is to insure payment of real estate taxes, interest, and possible principal payments on mortgages when due. The amount any pool member would contribute to this fund perhaps should not exceed 50 per cent or 75 per cent of the total of such obligations as he may have for one year. Although each pool member has an interest in protecting the title to all pooled land, it would seem that a separate account should be kept for each member and that, in case of no delinquency, interest on the deposited fund should be credited to each member's account.

7. DURATION OF POOLING AGREEMENT

It would seem that perpetual pooling contracts would be preferable to contracts for a shorter period of years. Fifty to 100 or more years may pass before all or even the largest part of these minerals will have been mined. If it is not practicable or legal to obtain perpetual contracts, the contract used should run for the longest period found practicable, with provision for renewal from time to time as long as any lands in the pool have not been fully investigated or exploited.

Because of the peculiarities of the oil business, it would seem that any attempt to make the cooperative pooling of mineral rights a "get-rich-quick" program rather than a more or less permanent investment trust, is likely to prove disappointing to the landowner. Further study is necessary before definite recommendation can be made as to the period for which the pooling contract can and should be drawn in order to be most advantageous to owners of potential petroleum-producing acreage in various parts of the country.

8. PROBLEMS OF MINERAL ACREAGE DEEDS

To facilitate efficient management of the pool's interest, it is essential that the farmer landowners give the pool a mineral deed for the undivided fractional part of the royalty rights pooled in exchange for headrights or shares in the pool. Since the mineral deed may become null and void through faulty title, mortgage foreclosure, tax delinquency, or voluntary sale, basic principles relative to preventing unnecessary loss of pooled acreage must be developed. Since a mineral deed accepted by the pool would be the only security and justification a pool would have for issuing headrights, representing a right to share in the proceeds that may be derived from pooled lands, it is important that all practicable precautions be taken to prevent the pool's interest from being dissipated. The following precautions should be given consideration.

(a) *Clearing title.*—The requirement of an abstract of title to all lands accepted by the pool would be an ideal arrangement, but the time and expense that would be involved in meeting such a requirement might in many cases prove prohibitive. Abstracts of some lands, the titles of which would run back to the old Spanish land grants, would cost hundreds of dollars. To require an abstract of title for each tract of land would necessitate maintaining a large and expensive legal department to examine the thousands of abstracts submitted. In any event, every practical means should be taken to safeguard title.

For every tract accepted by the pool, the chain of titles should be run by a competent field man or should be purchased from an abstract company. In cases in which land is mortgaged by a recognized company it will be necessary only to run the chain of title back to the date of the mortgage, for mortgage companies always require abstracts and examination of the titles by competent attorneys. In other cases an abstract of title should be obtained, if the cost is not unduly high.

Special care must be taken to be assured that no part of the mineral rights have been conveyed before, or were conveyed after, the date of the mortgage. The procedure here outlined would uncover faulty titles caused by delinquent taxes, sale or lease of mineral rights, delinquent payments on mortgage indebtedness, and other possible incumbrances incurred after the mortgage was issued. The size of the mortgage debt in relation to the value of the property mortgaged is an important consideration. No acreage should be accepted by a pool if there is any reason to believe that the mortgage debt is too high or that there is any other probability of foreclosure.

(b) *Cancellation of headrights.*—Under the statutes of the various States a farmer can dispose of a mineral deed without consulting the individual or agency that holds a mortgage on his land. This deed, however, may become null and void if the land in question changes ownership through tax sale, faulty title, or foreclosure on mortgage placed on the land prior to the date of the mineral deed. Consequently, when a cooperative pool or any other agency accepts a mineral deed from a landowner it also accepts the risk of losing the right to share in proceeds which may be derived as lease, bonus, or royalty income from such land.

If a landowner whose acreage has been accepted by the pool should lose such accepted acreage through foreclosure, tax delinquency, or other means, he should automatically lose his share or shares in the pool. Otherwise pool members who protect their titles to pooled lands would have their interests in the pool dissipated or thinned out. If the mineral rights lost by the pools are still considered desirable, they may be repooled by the new owner of the land.

The pool should protect itself further, so far as the laws of a State permit, by the inclusion of a clause in the mineral deed accepted from each pool member providing for immediate cancellation of the deed and of the headrights issued to the member upon proof of any misrepresentations made in writing by the pool member with respect to title to his land and his financial status. Damages to the pool in a stipulated sum might further be provided for, to guard against such misrepresentation.

(c) *Negotiability of headrights.*—The rights to a part of the proceeds of the pool, which a farmer receives when he pools his acreage, should be negotiable only on condition that the original owner protects title to the land represented by the headrights. In other words, it would be unfair to members of the pool who retain and protect title to their pooled mineral rights, to permit the sale of headrights by certain members without making such headrights subject to cancellation if the acreage represented by them is lost to the pool.

In general, if the pooling of mineral rights is desirable, the sale of headrights, except in emergencies, should be discouraged. If, as here suggested, the headrights are made subject to cancellation when the acreage they represent is lost by the pool, the price of headrights may be small. On the other hand, if they are not subject to cancellation and are negotiable, many farmers would find it helpful to be able to sell them for enough money to forestall mortgage foreclosure and sale of their property for taxes. It would seem desirable, therefore, for the pool to establish a revolving fund for the purpose of helping distressed farmers to meet their taxes and their payments on mortgages. Security for such a loan might be the right to the pro rata income to the pool which would otherwise accrue to the farmer to whom the loan was made. Although this phase of a pooling program does not affect the fundamental merits of the plan, it is important enough to demand serious consideration.

9. BASIS FOR ACCEPTANCE OF POOL ACREAGE

Under no conditions can the geologist or mining engineer be positive that a petroleum reservoir underlies certain land. Geologists, however, have worked out a regional geological basis for classifying different portions of the country as: Very likely oil territory, quite possible oil territory, slightly possible oil territory, or territory with no chances whatsoever for producing oil or gas. By the use of certain geophysical instruments, geologists can narrow the potential producing acreage by locating subsurface structures and salt and sulphur domes, but the favorable structures can not be proved productive until drilled.

The high cost of using the existing scientific instruments to locate structures, and the limitations of the instruments, make it impracticable to use them in selecting acreage to be included in mineral

acreage pools. In fact, the practices of the major oil companies in acquiring spreads differ in various areas and among different companies. Some companies place more reliance on geology than do others. In determining the location for a test well, some ignore surface geology and rely upon the logs of wells already drilled. If a potential producing area is perfectly flat, or if the structural geology is obscure for some other reason, a major company may send out its scouts with instructions to take one, two, or more, quarter sections of land in each township in that area.

Many of the major companies differ widely in opinion as to oil possibilities in certain areas and on specific tracts of land. It is said that the famous Seminole oil field in Oklahoma and other existing large producing fields were once looked upon with disfavor by many geologists, and, consequently, by the major oil companies that employed these geologists. As a result of this lack of definiteness as to the location of oil or gas, certain major companies invest huge sums of money in a given area while others consider the area absolutely condemned and will not buy or lease a single acre in it. Since disagreements constantly occur among the most eminent geologists, the only potential areas that can confidently be rejected by a co-operative mineral acreage pool are those areas that are unanimously condemned or, at least, nearly unanimously condemned.

The controlling factors in determining which acreage should be or should not be accepted in a particular pool are: (1) Existing geological data, (2) state of development of the oil industry in the area, (3) status of leasing activity in the area, and (4) need by the pool for one or more tracts of land in the area in question in order to give the cooperative pool what might be considered a desirable spread.

To assure the members of a particular pool that their interests will not be dissipated or reduced by accepting, for the pool, lands with less potential value, requires trained leadership and the help of a high-grade staff of geologists and other specialists in different phases of the oil business. So far as possible, the pools should select their tracts on the basis of information that is as scientific as that used by any of the major oil companies.

In spite of every precaution that may be taken, most of the pooled acreage undoubtedly will be nonproductive. There is no known way in which farmers in any one pool can be assured that only lands having petroleum-producing potentialities that equal or exceed those of their own lands, will be pooled. The mere fact that all of the acreage pooled is potential in character means that no definite certain valuation can be placed on any one tract. As a single unit, a small tract of possible or probable producing land may have little or no value; but as part of a large spread of acreage in the path of possible and probable production, each unit of land in the pool, as shown above, may become a valuable asset.

10. SIZE OF POOLS

The number of units should be kept within reasonable limits in order that the handling of the pool may not become unwieldy. If too many units are accepted by any one pool, the psychological effect may be bad. The owner of a headright or share of stock in a pool consisting of 3,000 shares would receive one three-thousandth part of the proceeds, but the owner of a share of stock in a pool consisting of

50,000 shares would receive only one fifty-thousandth part of the proceeds. Although the relative return per share might be the same, a farmer is likely to understand better and take more interest in the smaller pool. The minimum number of tracts in the pool, however, should be large enough to give what the oil industry considers a good spread, whether the land is in one block or is scattered over several States.

The question of whether the tracts should comprise a solid block of acreage or a checkerboard of acreage in many areas, does not appear to lend itself to any one answer. In the immediate vicinity of production it might be distinctly desirable to accept only contiguous tracts in any one pool, whereas it might be decidedly disadvantageous to follow that practice in areas remote from any lease play or production. If the cost of organization is assumed by the pool members, it might be wise policy to limit the size of a pool to one location. If, on the other hand, the expense for organizing and completing pools is assumed by a corporation in exchange for a percentage of the income that may be derived from pooled acreage, it would seem that the choice as to whether the spread should be a block or a checkerboard of acreage might be left with the corporation.

Possible statutory provisions that might prevent a pool located in one State from pooling mineral rights in several States might limit the activities of a pool. Although alien ownership of mineral rights is not restricted in the petroleum-producing States of the Southwest, this phase of the problem must be studied in greater detail before a program of cooperative pooling of mineral rights can be projected into other regions of the United States.

The fact that the size of land-ownership units differs in the various States suggests the need for organizing any given pool to issue stock (or what usually are called headrights) on the basis of different acreage units. The ownership of a section of land in Texas, for example, is about as common as is the ownership of an 80-acre tract in Oklahoma. A pool should be set up to meet these local situations.

THE ORGANIZATION AND MANAGEMENT OF FARMERS' POOLS

Effective organization with experienced management is necessary to give farmers needed bargaining power in the disposition of their potential mineral resources. If it is conceded that cooperative pools offer the soundest basis for the necessary organization, the question arises as to how such pools can best be brought about and be provided with suitable management.

POOL ORGANIZATION AND MANAGEMENT BY FARMERS THEMSELVES

An organization formed, owned, and controlled by the farmers themselves has the advantage of simplicity and directness of farmer control. Such a pool, set up in conformity with favorable permissive State or Federal legislation, and without direct Government aid, may be regarded as the most desirable type of organization if, and when, it can successfully achieve the basic purpose, namely, protection of the farmers' mineral rights and the obtaining of maximum returns from their mineral resources.

The extent to which this form of cooperative action may be expected to be successful in the near future, however, is somewhat uncertain. Cooperative experience in pooling mineral rights is not extensive. To many farmers it constitutes a new field of joint action. Moreover, there are certain basic differences between this field of cooperation and those fields in which a large number of farmers have become accustomed to working together for their mutual advantage.

Oil and gas developments are uncertain. Farmers who obligate themselves to pay salaries and other expenses for organizing and managing their pools necessarily assume the risk of losing what they have advanced to the pool without obtaining any return. Another difficulty with direct farmer management of pools arises from the fact that the acreage included should in most instances embrace scattered tracts in widely separated areas. This tends to complicate the problem of direct organization and management by the membership.

Many farmers who own potential mineral resources will no doubt be deterred from joining a pool if the outlays for management and operation are in any degree heavy while the question of returns remains problematical. It should be possible for a group of farmers who initiate a pool, to find an individual, perhaps a member of the pool, or an incorporated agency, able and willing to assume the risk of financing the organization and management costs in return for a contract giving a stipulated percentage of any income from the pool, when and if such income accrues. Under such a plan membership could be solicited and desirable acreage signed up under assurances to prospective members that they assume no financial responsibility but merely assign a part of their mineral rights to the pool and thereby obtain the privilege of sharing in any pool income from leases, and from royalties if oil is discovered on any part of the pool acreage.

After several pools have been organized, either by means of funds subscribed by the pool members or advanced by some individual or individuals who assume these outlays in return for a stipulated interest in the pool, it may be possible to bring about a federation or consolidation of two or more existing pools. In most cases such an arrangement should reduce the overhead cost of management per unit of acreage included. It might also, if found desirable, be made a means of increasing the spread of acreage in which each member has an interest.

FEDERAL ORGANIZATION AND MANAGEMENT

The Federal Government might undertake to develop and manage pooling programs as in the case of the Osage Indian Pool. Although in many respects this pool offers a desirable pattern, the organization of farmer pools must, of necessity, be somewhat different. The Indians were wards of the Government at the time the pool was organized. All acreage in the reservation was included in the pool. There was no selection of acreage for any purpose. These conditions greatly simplified the problem of pool organization and management as a Government enterprise. As applied to the type of farmer pool discussed here, there are practical objections to the Federal Government acting as a management agency.

STATE ORGANIZATION AND MANAGEMENT

Each State might undertake the responsibility of organizing and managing pools within its boundaries. Assuming that all States in which farmers own potential mineral-producing acreage would adopt effective programs to establish sound pooling organizations, there might be fewer objections to this plan than to Federal organization and management. It is not probable, however, that the various States where such pools are needed will adopt supervisory or regulatory measures or go to the expense of establishing offices to sponsor any given type of pooling organization. The cost of maintaining offices for this work in several States would perhaps collectively exceed the cost of a Federal agency. State organization and management would also be hampered by the fact that a pool that would meet the needs of the farmers most effectively may in many cases be interstate in character.

ORGANIZATION AND MANAGEMENT BY PRIVATE CORPORATIONS

A private corporation may organize and manage one or more pools under contract with farmers. Under the terms of such contracts the corporation may be obligated to pay all the expenses of organization and management of the pools in exchange for title to a certain undivided part of the mineral rights acquired. Several corporations are operating on this basis to-day in the mid-continent oil field. They receive title to a minimum of 25 per cent of the mineral rights acquired by the pools. They are not required to conform to certain conditions regarded as advantageous to cooperative pools and to which reference is made in this report.

One objection that has been raised to this arrangement, from the farmers' point of view, is the fact that such a corporation will in all probability capitalize the interest it acquires under its contract with the pools, and sell the capital stock to the public. With a 25 per cent interest in pooled acreage thus represented by negotiable stock, there is a possibility that a major part of this stock may be controlled by interests unsympathetic with the farmer and the cooperative movement. Although it may not be probable that an agency unfriendly to the farmer would purchase control of outstanding stock for the purpose of preventing the pool from leasing any part of its 75 per cent undivided interest in pooled mineral rights, the mere possibility of such an occurrence in any pooling program warrants serious consideration. This objection may be lessened or perhaps removed by placing restrictions on the sale or negotiability of the capital stock of the corporation.

PRIVATE ORGANIZATION AND MANAGEMENT UNDER FEDERAL SUPERVISION

The Federal Government might undertake to provide a certain measure of supervision and control over mineral rights pools and over corporations created for the purpose of organizing and managing such pools. This might require statutory provisions for the incorporation of pools, or of management corporations, under Federal law, or it might be found possible in return for the advantage of obtaining Federal approval of a given pool, or managing corporation

to bind it to stipulated standards even though incorporated under State law.

In any case this assumes that prospective pool organizers, or corporations for the organization and management of farmers' pools, will adopt methods, plans, and contract forms formulated or approved by the Federal Government. It is also assumed that the personal record of the organizers themselves will be scrutinized by the Federal agency charged with supervision.

The approval, by an authorized agency of the Federal Government, of pools or of management corporations, would presumably give them a decided advantage over any rival organizations in signing up desirable acreage and, in the case of a corporation, in obtaining pool management contracts. It would tend to insure the prospective members of the pool or pools that their interests had been duly considered and that they were reasonably safeguarded in the mineral-rights contracts that they were asked to sign. It also should give the pool better credit standing.

Federal approval and supervision would also presumably reduce the cost of promoting pools, because of its tendency to lessen sales resistance to a pooling program. Hence the organizing and managing corporation if there is one, as well as the pool members, might profit by such an arrangement.

It has been suggested that the Federal Government might set up a revolving fund for the purpose of making loans to the pools or to the organization and management corporations. This might in some respects simplify the problem of supervision since various conditions deemed essential to an equitable pooling plan could be made a condition of the loan contract.

The security for Federal loans to pools or to management corporations would have to be the pooled mineral rights, represented by either the rights themselves or by some paper or contract giving legal claim to the income from such rights. That the value of such security would be difficult to appraise may be inferred from what has been said earlier in this report about the uncertainty in oil developments. Such loans would necessarily mean that the Federal Government would assume a somewhat speculative risk. For the Government to engage in regulating and financing of mineral rights pools raises important questions of public policy.

SUMMARY AND CONCLUSIONS

There is no certain way to locate oil and gas in advance of the drill. Authorities appear to agree, however, that there are about 1,000,000,000 acres of possible and probable oil-producing lands in the United States. It is also generally agreed that, with the exception of the potential producing area held by Federal and State Governments, farmers own the largest part of this area.

It is a well-established fact that most of the farmer landowners, who once owned the mineral rights in the major producing fields, sold or leased their rights for mere pittances compared with what the rights proved to be worth. The farmer is not in position to keep informed as to the development of the oil industry. The highly speculative nature of the enterprise, the high cost of drilling for oil or gas, and other characteristics of the production and marketing

of petroleum, all tend to prevent unorganized owners of mineral rights from marketing their rights most effectively. The mineral rights are usually leased or sold before any drilling operations are started in the community. It is not surprising, therefore, that farmers have frequently been induced to part with their mineral rights on very unfavorable terms.

Without an effective organization for management of his mineral rights, a farmer is often forced to choose between the risk of parting with a potential fortune for a mere pittance if he does sell or lease his mineral rights, and the risk of getting nothing at all if he does not sell or lease them. Many schemes have been developed to take advantage of the farmers who own potential petroleum-producing land.

The Osage Indian rights pool is the outstanding example of successful pooling of potential mineral resources. As a result of effectively pooling the potential mineral interests on their reservation in 1896, each of the 2,229 members of the tribe (or the heirs of each member taken as a group) shared equally in the total of \$241,546,289.82 received from all oil and gas sources up to June 30, 1931. It is a significant fact that more than half of the total income received was derived from the sale of leases and bonuses, and not from royalties. From the experience of other landowners, it seems safe to assume that without collective bargaining power in the marketing of their mineral rights, the income the Osage Indians would have received from rentals and bonuses would have been comparatively small.

Although the situation of the Indians as wards of the Government differs materially from the situation of farmers who own potential mineral acreage, many of the most important features of the Osage pool can be adapted to farmers' cooperative pools. To avoid individual or selfish group control, farmers' pools should follow the traditional principles of one man, one vote, or place a definite limit on the number of shares or headrights any one member may own. Other protective features needed are restrictions on the management activities. Officers of a pool should be forbidden to convey title to any part of pooled mineral rights or to engage in production or distribution activities with pool finances. Viewing the pooling of mineral rights as a long-time potential investment rather than as a get-rich-quick scheme, it would seem that the period covered by the pooling contract should be for as long a period as is practicable and legally possible.

General practices with respect to leasing or purchasing mineral rights that have been determined as practicable by major petroleum-producing companies should be made the basis for accepting acreage by the pools. A farmer should not pool more than an undivided half or some other fractional interest in the mineral rights he owns. In exchange for a deed to the mineral rights accepted by the pool, the pool member should be given a certificate or headright representing a proportionate fractional interest in income derived from the entire spread of acreage in the pool. Headrights should not be negotiable. If the pool loses title to mineral rights after headrights have been issued, the corresponding headrights should be canceled. This is essential in any pooling plan, to prevent the soundness of the pool from being undermined through loss of mineral rights without correspondingly reducing the number of headrights.

The temptation is unusually great under existing conditions in agriculture to sell mineral rights at any price offered. It appears highly desirable, therefore, that early action of some sort be taken to bring at least some of the more important problems here considered to the attention of farmers and to warn them against disposing of what may prove to be valuable mineral rights for inadequate considerations before available means for protecting their interests have been adopted or such additional safeguards developed as may be necessary to conserve those interests.



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